UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE
Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**

JULY 1951

EROSION CONTROL PRACTICES DIVISION

Soil and Water Loss in Relation to Crops and Land Conditions - George N. Sparrow, Tifton, Georgia.-"Four rains occurred in July which caused appreciable loss of soil and water. The highest intensity encountered was 3.26 inches per hour over a 37 minute period on July 17, with a rainfall at an intensity of 2.28 inches per hour over a 16 minute period occurring on the following day. From data gathered from those two rains, as well as from other rains of the month, it appears that water losses in midsummer are of greater significance on 3% slopes than are soil losses. This is being very tentatively attributed to a thickening of vegetative cover on grass and summer legume plots, to an influx of native weeds and grasses after laying by corn, and to protective foliage as peanuts spread and develop cover between rows.

"Soil losses which have been ascertained to date were heaviest in the early spring from plots which were plowed or otherwise had little vegetative cover. Losses were heavy then from young oats and from partial sod of Coastal Bermuda grass. A general decrease in soil losses was evident in May, when peanuts and corn were young and being cultivated. The greatest decrease in soil loss was from plots in oats and in Coastal Bermuda grass. Overall soil losses were least in July, although it was then that rainfall amounts and intensities were highest. The descending order of soil losses resulting from July rains with respect to plot cropping was as follows: peanuts, corn, crotalaria on oats stubble, Coastal Bermuda grass.

"Highest water losses were experienced on July 29, when a 2.83 inches of rain fell with a maximum intensity of 2.64 inches per hour over a period of 50 minutes. Loss of water from corn reached a maximum of 53 percent. A maximum loss of 39 percent was measured from one plot of peanuts. The highest loss ascertained from a Coastal Bermuda grass plot was but 5 percent. Averaged from all the heavy rains in July, water losses were highest from corn after laying by, with losses from peanuts following as a close second. Losses from plots in crotalaria on oats stubble were appreciably less than losses from corn and peanut plots, but were slightly greater than losses from Coastal Bermuda grass.

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** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

"The data above are reported as indicative and as a matter of interest. Further accumulation of data is required before results can be construed as significant."

Sugar Cane Yields and Efficiency of Water Use - R. M. Smith, Mayaguez, Puerto Rico.-"Field results from Aguirre indicate some tendency during the past season for water use to increase with cane yields. However, the data strengthen our previous conclusion that highest possible yields per acre result in greatest efficiency of water use. Approximations of the efficiency of both rainfall and irrigation on the several fields for the year gives an average consumptive use of 0.15 inches per day, which checks with last year's results. Individual field calculations range from 0.125 to 0.195 inches per day. Sugar cane yields per acre averaged about 42 tons on a 13 month basis (a standard cane year). A 62 ton per acre crop would apparently use about 0.20 inches of water per day. Thus, for the first 42 tons, water use per day averaged 0.0036 inches per ton, whereas for a 20 ton increase above 42 tons the expected average use would be about 0.0025 inches per ton."

Winter Cover Crop Management in Maryland Tobacco Production - C. S. Britt, Beltsville, Maryland.-"Yield data have been completed on the cover crop tobacco culture plots for the 1950 season. The value of this crop has not yet been determined. Outstanding yields of tobacco were obtained following the delayed turning of good cover crop mixtures. Tobacco grown following early or normal turning under of vetch grown in mixtures with wheat, rye, or ryegrass gave an increase of 230 pounds of tobacco per acre compared with tobacco grown following ryegrass alone. By turning under these cover crop mixtures one month later, another 199 pounds per acre was added to the yield of the tobacco crop. The delayed turning of ryegrass alone gave only a slight increase in yield.

"Vetch alone continued to give fair yields of poor quality tobacco while plots with no cover gave very poor yields. The delayed turning of the mixtures gave over 500 pounds more tobacco than the plots with no cover."

What Happened to the 1951 Wheat crop in the Southern Great Plains - H. H. Finnell, Goodwell, Oklahoma.-"A considerable portion of the month was utilized in gathering and preparing material for a report on what happened to the 1951 wheat crop in the Southern Great Plains to the Land Use Committee of the Southern Great Plains Council meeting August 1 at Laramie. Assembling information from all available sources, supplemented by a small amount of personal observations in a restricted travel area, provided the basis of the report. The conclusion reached was that the winter wheat abandonment of the five Southern Great Plains states, ranging from 26% in Kansas to 80% in New Mexico, was predisposed by dry topsoil conditions which inhibited secondary root growth, thus leaving a poorly nourished plant to the mercies of severe insect infestations and abnormally severe winter temperatures."

Surface Mulch Corn Culture - T. L. Copley, Raleigh, N. C.-"Nitrogen deficiency during early growth of corn has been noticed again this year on mulch corn following annual lespedeza residue. Reduced size and vigor accompanies the nitrogen deficiency. Similar results were reported by T. W. Edminster at Blacksburg, Virginia, and their studies are showing better results where the fertilizer was applied below the mulch layer. We need to investigate this possibility.

"Corn, Grain, Kudzu Rotation - Kudzu continues to reestablish itself after all crops in this rotation where liberal rates of fertilizer is applied to corn or other grain. It is thinning out to a noticeable extent, however, where light fertilization is used. Kudzu has made a complete ground cover in the corn middles at August 1."

Interest in Brush Control - Harley A. Daniel, Guthrie, Oklahoma.-"There is still lots of interest in our work on brush control. On July 26, 1951 Dr. H. H. Bennett signed a trust fund agreement between the Flying Farmers Incorporated and Soil Conservation Service, United States Department of Agriculture. It provides for a cooperative program of investigations and research covering eradication or control of noxious brush and trees for pasture and grass land improvement and the conservation of soil and water."

Crop Residue Mulch System Reduced Soil and Water Loss on Corn and Soybean Land - D. D. Smith, Columbia, Missouri.-"The growing of corn and soybeans without plowing and with a surface mulch of crop residues for protection against erosion during the planting and early development stage of the two crops has resulted in very low runoff and soil loss during the 1951 season beginning with plowing or disking on May 1 and extending through July 20. Both mulched plots were in meadow in 1949 and in corn during 1950. The second-year corn planted through the surface mulch of shredded corn stalks lost 0.17 ton soil per acre in contrast to 1.20 tons soil loss under corn following 3 years of meadow, and 4.43 tons under corn following oats in an untreated rotation. The same low soil loss was measured from the plot on which soybeans were planted under a surface mulch of shredded corn stalks and disked rye.

"A second important point is that soybeans in 21-inch cultivated rows have allowed only about one-fourth the soil loss under corn when both were preceded by a meadow crop in which the grass predominated.

"Runoff and soil loss from 10.65 inches rain during the period from May 1 (date of plowing or disking, preparatory to planting) to July 20 are as follows:

	Runoff Inches	Soil Loss Tons/Acre
Soybeans following corn, with mulch cover	0.51	0.17
Soybeans following 1 year timothy-clover sod	.61	.35
Corn following corn, with mulch cover	.47	.17
Corn following 3 years timothy-clover sod	1.06	1.20
Corn following 1 year alfalfa-clover-timothy sod	1.10	2.33
Corn following oats (no treatment)	1.59	4.43

"Beef Gains from Rotation Grazing - Rotation-grazed Ladino Clover with bromegrass produced 300 pounds of beef per acre by July 24. Grazing began April 30. The pasture is divided into three blocks. One block is grazed at the rate of six head per acre, while the other two blocks are making regrowth. Ten days are necessary at this rate to utilize the growth which accumulates in 20 days. Cattle started their 5th trip over the pasture July 24. Orchard grass with Ladino Clover had produced 223 pounds of beef per acre by July 24, while Bromegrass which receives nitrogen fertilizer spring and fall had made 213 pounds by the same date."

Some Observations of Different Methods of Utilizing Sweet Clover Residues - F. H. Siddoway, St. Anthony, Idaho.-"Studies were started utilizing sweet clover residues turned completely under with the moldboard plow; mixing the residues with the surface soil by offset and oneway disk plowing; and leaving the residues on the surface by plowing with sweeps. The sweet clover was plowed June 25 when it was at a height of approximately 18 inches. At this time the sweet clover was beginning to show signs of dreuth and there was no available moisture to plow depth (5-6"). One of the most apparent differences after plowing was in soil structure. The dry, hard packed, silt loam soil responded quite differently to the implements used. The subsurface plow altered soil structure the least and this soil structure plus the residue remaining on the surface could be expected to offer adequate erosion control and moisture penetration. The moldboard plow left the soil in a rough condition with a fair degree of aggregation but with the residue completely turned under there is little protection against wind erosion. Even though the oneway disk plow left part of the residue on the surface, the soil was pulverized a great deal. It was necessary to go over the sweet clover twice with the offset disk to even approach a satisfactory kill. This double plowing plus the inherent pulverizing effect of disking left the soil as 'dust'.

"July 27, one month and two days after plowing, sweet clover survival counts were made as follows:

Method of Plowing	Plants per Acre
Moldboard	140
Subsurface Plow	
Disking before plowing	0
Clipping	0
No preliminary treatment, to be disked later)	0
Offset disk (twice)	5000+
Oneway disk	1000

"The number of sweet clover plants surviving after plowing with the offset disk, and the degree of pulverization was considered too large to be practical and was replowed with a subsurface plow and dropped from the experiment."

Terrace and Wheat Yields - C. J. Whitfield, Amarillo, Texas.-"Four of the terrace plots were in wheat this year. Two of the plots were on land with graded open-end terraces and two on level closed end terraces. There was a great difference in yield on the two types of terraces. The graded terraces yielded 5.7 bushels and 8.5 bushels per acre and the level terraces 0.5 and 1.5 bushels per acre. There are probably several factors that contributed some to the differences in yield on the two terrace systems. Greenbug damage showed up first on the level terrace plots and continued to be the heaviest during the winter and spring. Although the reason for this is not definitely known, it is possible that water impounded in the level terraces during the summer and fall of 1950 may have furnished enough additional moisture to produce a better vegetative growth for the greenbugs to live through the winter on. The yield on the level terrace plots was also reduced some late this spring by water standing in the terrace channels during the heavy May rains.

Wheat Yields in Relation to Tillage Methods - The stubble mulch plots were combine harvested on July 10. Yields were below average due to a combination of unfavorable circumstances during the crop year, related to drouth, greenbugs, cutworms, extremely low temperatures during the winter, and an inadequate secondary root system. The grain, however, was of reasonably good quality ranging from 60 to 62 pounds per bushel in test weight.

Tillage	Yield		Straw-Grain Ratio	Inches Available water in top 3 ft. of soil at harvest
	Grain Bu./Acre	Straw Lbs/Acre		
		Continuous Wheat		
Onewayed	7.4	995	2.24	--
Subtilled	8.6	1085	2.10	--
Hoemed	10.8	1620	2.50	--
		Wheat-on-fallow		
Onewayed	9.1	1355	2.48	.44
Subtilled	13.0	1605	2.06	.62
Delayed Subtilled*	10.8	1335	2.06	1.14
Hoemed	9.6	1335	2.32	.48

* Fallow in which cultivation is not commenced until the spring following harvest.

"Subtilled outyielded onewayed wheat both in the case of continuous wheat and of wheat-on-fallow. The yield advantage shown by stubble mulching was 1.2 bushels on continuous wheat and from 1.7 to 3.9 bushels on wheat-on-fallow. Wheat on subtilled fallow, especially on delayed subtilled fallow, would have given a much better account of itself had it not received more severe damage by hail in mid-June than the other plots which were less advanced in maturity.

"Subtilled wheat showed the usual trend toward a lower straw-grain ratio. Straw yields ranged from about 1000 to 1600 pounds per acre and were in decided contrast to the straw yields of the 1949 crop which ranged up to 6000 pounds per acre. Straw-grain ratios in the past have ranged from 1 to 7 and have averaged about 2.25.

"Plowing after harvest was extremely difficult due to the remarkably hard, dry character of the soil. The amount of available water remaining in the top 3 feet of soil at harvest time ranged from .44 to 1.14 inches. The wings of the 30-inch sweeps used on the subtillage machine showed a tendency to bend upwards and scrape the surface of the ground if great care was not exercised to keep them in proper adjustment. It was found necessary to place 1500 pounds extra weight on the sweep machine to keep it in the ground with the blades of the sweeps in the proper horizontal plane."

Land Clearing and Drainage Cost Data for Poorly Drained Soils in Central Wisconsin - H. O. Anderson, LaCrosse, Wisconsin.-"Tabulation and preliminary summarization of land clearing and drainage cost data for poorly drained soils in central Wisconsin was completed. Copies of tables from this study follow. The summary tables have been sent to a number of Operations personnel at District, State, and Regional offices for review and criticism. A more complete report will be prepared after the reviews have been returned."

Table 1.--Distribution of Farms According to Land-Clearing Machinery Rental Costs per Acre for Different soils Groups

Range in Cost Per Acre	Soils Group Number*					Total	
	1	2	3	4	5	Number	Percent
Under $8	2	0	0	1	1	4	7
$8 - $12	6	0	3	1	0	10	18
$13 - $17	12	2	3	4	0	21	37
$18 - $22	5	2	1	2	3	13	23
$23 and over	1	2	3	0	2	8	15
Total	26	6	10	8	6	56	100

* Group 1: Freer, Trappe, and Milaca silt loams; Group 2: Poskin, Brill, and Marathon silt loams; Group 3: Konnan silt and sandy loams; Group 4: Chotok and Onamia silt loams; Group 5: Miscellaneous soils.

Table 2.--Cost of land clearing with different types of equipment

Type of Equipment*	Number of Farms	Acres	Hours	Equipment Rental, cost per acre	Farmers Own Equipment**		
					Tractor	Labor and team	Total
A	5	6.1	9.3	$14	$6	$10	$30
B	35	8.4	13.7	15	16	17	48
B&A	16	9.1	15.4	15	17	18	50
Total & Ave.	56	8.4	13.8	$15	$15	$17	$47

* Types of Equipment: A - "A" -drag; B - Bulldozer; B&A -Bulldozer and "A"-drag.
** Per hour rates for farmers own equipment: Tractor - $1, labor 50 cents, team 25 cents.

Table 3.--Land Clearing Costs for Different Soils Groups

	Soils Group Number*					Average,
	1	2	3	4	5	All Farms
Farms, number	26	6	10	8	6	56
Acres	9.3	6.3	8.5	9.3	5.1	8.4
Hours, per farm	14.1	11.4	15.9	12.2	13.4	13.8
Hours, per acre	1.5	1.8	1.9	1.2	2.6	1.6
Cost per acre	$14.35	$17.78	$16.33	$11.61	$23.72	$15.12

* See Footnote, Table 1.

Table 4.--Land Clearing, Liming and Fertilizer Costs, per acre, 4 Fields, Central Wisconsin, 1950

	Field Number				Average
	1	2	3	4	
Acres	8.3	5.8	5.0	4.0	5.8
Clearing Costs	$32	$27	$26	$31	$29
Cash	$21	$11	$11	$17	$16
Non-cash	11	16	15	14	13
Lime	2.4 T. 5	2.6 T. 5	4.0 T. 8	6-1/4 T. 12	3.45 T. 7
Fertilizer	482lbs. 10	517lbs. 13	800lbs. 16	800lbs. 16	621lbs. 13
Total	$47	$45	$50	$59	$49

Table 5.--Terracing and Ditching Costs, Central Wisconsin, 1950

	Terracing - 76 Farms		Ditching - 24 Farms		
	Per Farm	Per 100 Feet	Per Farm	Per 100 Feet	
				Average	Range
Acres	14.0	.33	14.6	.63	.17 - 1.1
Hours	13.7	.32	10.0	.43	.23 - 1.1
Lineal Feet	4240.0	—	2321.0	—	— - —
Cost	$57.55	$1.36	$42.10	$1.81	$0.80 - $5.60

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"Rainfall for the month of 2.93 was well below the normal of 4.27 inches. Two storms, however, totaled each 1.06 inches. Five-minute intensities of 4.92 and 3.24 inches per hour caused runoff on the plowed corn watersheds.

Table 1.--Runoff and erosion on cornland watersheds, July 1951

Watershed	Runoff (inches)		Soil loss (lbs/acre)	
	July 11	July 23	July 11	July 23
118 (plowed; straight rows)	0.25	0.33	551	405
113 (plowed; contour)	.17	.22	319	425
111 (mulch; contour)	0	0	0	0
187 (contour strips)	.01	.02	10	13

"Mr. Dreibelbis reports that soil moisture in the cornfields by the end of July was quite low. Deficiency precipitation and good stands of corn were large factors in the rate of soil-moisture depletion as illustrated in table 2. It is to be noted that soil moisture in mulch watershed 111 has been greater than that in plowed watershed 113. Also of importance is the fact that the greater stand of corn on the mulch watershed is depleting soil moisture at a greater rate than that on watershed 113.

Table 2.--Soil-moisture depletion in cornfields, July 12 -31, 1951

Date	Inches of water in top 14 inches of soil - Watershed 113 (normal plowing)	Watershed 111 (mulch)
July 12	3.30	4.46
July 31	1.80	2.17
Difference	1.50	2.29
Plus infiltration for July 23 and 28 storms	1.23	1.45
Total soil moisture used in 18 days	2.73	3.74
Average rate per day	.15	.21
Corn stalks per 20-ft. row	22	33
Corn height (inches)	97	105

"Air-temperature gradients in the cornfield are greatly different than those in bare fields as illustrated by the data in table 3. The temperature gradient at 2:30 p. m. in the cornfield was such that the temperature increased at greater heights above the ground surface. The reverse was the case in the bare field. No data are available above a height of 42 inches.

Table 3.--Air temperatures in corn canopy and on bare surface on July 30, 2:30 p. m. °F

Height (inches)	Corn canopy	Bare surface
42	89 (maximum)	88
36	87	88.5
30	86	88.5
24	85.5	88.5
18	85	89
12	84.5	89.5
6	84	89.5
4	84	91
2	83.5	91
1	83.5	91.5 (maximum)

Hydrologic Studies - R. W Baird, Blacklands Experimental Watershed, Waco, Texas.-"For the month of July the rainfall totaled 0.13 inch compared to the normal for Waco of 2.08 inches. Crop production here is largely determined by the moisture accumulated in the last 3 months of the year plus that received during the spring and early summer. The monthly rainfall for the period October 1950 through July 1951, together with the normal and the accumulated deficiency, was as follows:

Table 1.--Monthly Rainfall

Date	Gage No. 69	Normal at Waco	Accumulated deficiency
October, 1950	0.91	2.59	1.68
November	1.14	2.69	3.23
December	.40	2.81	5.64
January, 1951	1.44	2.19	6.39
February	2.39	2.37	6.37
March	1.76	3.08	7.69
April	2.61	4.24	9.32
May	3.11	4.56	10.77
June	4.36	3.16	9.57
July	.13	2.08	11.52
10-month total	18.25	29.77	

"At the end of the month drought conditions were severe, pastures were brown, all feed crops not matured were severely reduced in yield, and cotton severely damaged. Farm ponds for livestock and domestic use were at a low level or dry and many farmers were hauling water.

"The effects of crop sequence on moisture this season was very pronounced on an area with grain sorghum following Madrid clover in comparison to grain sorghum following oats. The area with Madrid clover in 1950 had 5 percent less moisture at the time of planting grain sorghum. The difference in moisture and the early growth on the area following clover this season resulted in the grain sorghum maturing 2 weeks earlier than on the area where grain sorghum followed oats.

"The percentages of moisture at the designated depth intervals on July 3 were as follows:

Sorghum following Madrid Clover		Sorghum following Oats	
Inches	Percent	Inches	Percent
0-6	17.3	0-6	21.2
6-12	19.9	6-12	22.1
12-24	20.0	12-24	23.6
24-36	20.0	24-36	26.5

"The cotton root rot damage on the station is much less to date than it has been during the past two seasons. However, it is still a major problem and more damage is expected before the season closes. The 3-year cropping system of cotton, oats, and grain sorghum combined with early deep plowing soon after the oats and grain sorghum are harvested apparently is giving a fair degree of control. The grain sorghum lends itself to early summer land preparation in comparison to corn in the system."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"In July we received 6.03 inches of rain at the Meteorological Station, which is approximately double the long-time average rainfall for the month. In the first 7 months of 1951 we have received 26.7 inches of rain which is approximately 2.2 inches more than the average yearly rainfall.

"During the 3-day rainy period July 10-12, which caused the Kansas flood we received 5.0 inches of rain at the Meteorological Station. There is considerable interest as to results of the runoff records from our watershed W-3, containing 481 acres, which is untreated and watershed W-5, containing 411 acres which is being placed in conservation practices and approximately 65 percent treated.

"Data in table 1 have been compiled but not completely checked which show some comparative figures on the two watersheds.

"The peak rates of runoff from watershed W-3 occurred at 6:45 a. m. on July 10, and was approximately 1.65 inches per hour. The peak rates of runoff at watershed W-5 was 0.87 inch per hour and occurred at 7:05 a. m. on July 10. The hydrographs show there was from 20 minutes to 1 hour lag in the peaks on watershed W-5 and in all cases the hydrographs were lower and more extended than the ones for W-3.

"In watershed W-5 there is one 43-acre cultivated watershed which is untreated, since the owner is unwilling at present to cooperate with us. Slope area computations show that the peak rates of runoff from this area was approximately 2.83 inches per hour.

"At the time of the storm period beginning July 10, the soil was moist due to a 1.64-inch rain which fell on June 26, and approximately 0.19 inch of rain between June 26 and July 10.

"On July 10, the corn was from 20 to 30 inches high, oats was poor, about 18 inches high and headed out, wheat was 18 to 20 inches high and fair, pastures were 4 to 6 inches high with good to excellent cover, meadow was approximately 16 inches high and was excellent.

"The average peak rates of runoff from the 4-acre watershed was as follows:

Table 1.--Comparison of runoff for storm of July 10-12, 1951
Watershed W-3 (untreated) - Watershed W-5 (approximately 65 percent treated)

Approx. time of rain	Watershed W-3			Watershed W-5		
	Rainfall Theisen weighted (8 gages)	Runoff	Rainfall minus runoff	Rainfall Theisen weighted (3 gages)	Runoff	Rainfall minus runoff
	Inches	Inches	Inches	Inches	Inches	Inches
Began 5:00 a. m. 7/10	2.66	1.62	1.04	2.84	1.35	1.49
End 8:00 a. m. 7/10						
Began 5:30 p. m. 7/10	1.35	.85	.50	1.30	.68	.62
End 3:00 a. m. 7/11						
Began 1:00 a. m. 7/12	1.03	.57	.46	1.00	.51	.49
End 8:00 a. m. 7/12						
Total	5.04	3.04	2.00	5.14	2.54	2.60

Table 2.--Average peak rates of runoff in inches per hour from approximately 4-acre watersheds under different land use practices, storm of July 10, 1951

	Corn	Oats	Wheat
	In./hr.	In./hr.	In./hr.
Straight row	5.20	4.98	5.12
Contour	3.48	3.72	3.48
Subtilled	3.63	3.42	3.83

"The maximum average peak rates of runoff from the three native grass watersheds was 1.49 in./hr."

Hydrologic Studies - A. W. Cooper, Auburn, Alabama.-"The July rainfall of 2.73 inches represents 49.5 percent of the 70-year average of 5.51 inches for Auburn.

"One rain of 1.57 inches caused runoff and soil loss from the erosion plots. A summary of the water and soil losses is given in table 1:

Table 1.--Soil and water losses from erosion plots, Auburn, Ala., July 2, 1951 - 1.57 inches rainfall

Plot No.	Slope	Vegetative cover	Water loss	Soil loss
	Percent		Inch	Lb./acre
1	2-1/2	Poor stand alfalfa	0.39	104
2	5	Cotton	.44	266
3	5	Small Sudan grass	0	0
4	5	Corn	0	0
5	10	Poor stand fescue and Ladino	.28	568
6	10	Corn	.13	407
7	10	Cotton	.51	5,300
8	10	Cotton	.49	5,290
9	20	Corn	.07	405
10	20	Corn	.03	300

"In cooperation with SCS Operations personnel, four infiltration measurements were made using the simulated rainfall type-F infiltrometer (table 2). These tests were made at the SCS Nursery at Thorsby on Ruston F. S. L. soil. The field had had a heavy sod of Bahia grass turned under in the fall of 1950 and was planted to corn. The tests were made on bare soil between the corn rows. During the second hour of the test, the infiltration rate was greater where there were 8 inches of topsoil than where there were 4 inches of topsoil. It is planned at a later date to make infiltration tests where there has been no heavy sod of grass turned.

"Permeability measurements of the Ruston F. S. L. are given in table 3." Both table 2 and 3 appear on page 13.

Table 2.--Summary of infiltration tests made with the infiltrometer on Alabama soils (July 1951)*

Test No.	Soil type	Soil surface condition	Depth of topsoil	Infiltration: Total 1st hr.	Infiltration: Total 2d hr.	Infiltration: Rate at end of 1st hr.	Infiltration: Rate at end of 2d hr.	Initial soil moisture: Depth (in.) 0-6	6-12	12-18	18-24
			In.	Inches		In./hr.		Percent			
97	Ruston F.S.L.	Bare**	4	0.71	0.24	0.38	0.21	10.5	16.9	17.3	16.3
99,100	Ruston	Bare**	8	.70	.41	.41	.41	10.5	16.9	17.3	16.3

*Data obtained jointly by SCS Research and Operations.
**Field in corn. Test made on bare surface. Heavy Bahia grass sod turned in fall of 1950.

Table 3.--Permeability of soils (Alabama)*

Depth of sample	Field moisture content	Moisture content saturated	Percolation: Field moisture	Percolation: Saturated	Volume weight	Water drained: 15 min.	Water drained: 15 hr.
Inches	Percent	Percent	In./hr.	In./hr.	Gm/cc	Cc/100 gm	
Ruston F.S.L.							
0-3	2.90	26.94	1.72	0.45	1.58	6.53	12.43
4-7	4.58	20.68	.96	.55	1.75	4.53	9.50
8-12	6.48	25.61	.39	1.27	1.67	6.26	10.90
18-21	7.81	25.31	.66	2.15	1.66	7.18	10.36

*Data obtained jointly by SCS Research and Operations.

Hydrologic Studies - L. Stolzy, East Lansing, Michigan.-"Precipitation for the month of July, as measured by the U. S. Weather Bureau type of standard nonrecording rain gages, amounted to 2.12 inches at the cultivated watersheds, 1.41 inches at the wooded watershed, and 1.85 inches at the stubble-mulch plots. These amounts are approximately 68 percent, 45 percent, and 60 percent, respectively, of the 50-year average July precipitation of 3.10 inches. July precipitation can be expected to equal or exceed 2.12 inches once in 1.65 years.

"On July 11 a group of men from the College made a trip to Coldwater, Mich., to inspect a grain seeder which is being used to sow a rye cover crop in corn at the last cultivation. The following men were present: Mr. Roy Decker, Head of the Farm Crops Department, Mr. Herbert Pettigrove from Farm Crops, Dr. Elmer Rossman, Farm Crops, Dr. Walter Carleton, Agricultural Engineer, Mr. Robert White, Agricultural Engineer (Extension), Mr. Claude Price, Farm Foreman, Mr. Elmer Rowland, and the Acting Project Supervisor.

"The idea for the conversion of this seeder was conceived by Elmer Rowland, student of Michigan State College and a W. A. E. employee of this office. A rye cover crop in corn at the last cultivation has long been advocated by men interested in conservation. However, it has not been possible to persuade farmers to carry out this practice, mainly because there has been no way by which the rye could be sown without an additional operation with some type of seed broadcaster. Mr. Rowland was given the loan of a tractor-drawn seeder sent here by the Mt. Vernon Implement Company for other purposes for which it was never used. The seeder box was located on the front end of an Allis Chalmers Tractor and driven from the rear wheel of the tractor by a device constructed by Mr. Rowland. This allowed for the use of the seeder and cultivator at the same time. In so mounting the seeder, it was possible to make his last cultivation in corn and at the same time put in a seeding of rye covered by the cultivators. This type of implement is very much needed in order to decrease soil loss in corn stubble during the fall and winter months."

Runoff Studies - N. E. Minshall, Madison, Wisconsin.-"Precipitation at Colby for the month was 4.82 inches, nearly all of which came in the first week. Precipitation for a 24-hour period on the 3d and 4th was 3 inches, all at rather moderate intensities, but the runoff amounted to 0.97 inch. The infiltration during the last part of this storm appears to be about 0.05 inch per hour.

"Precipitation at Edwardsville for the month was 4.0 inches and 2.85 inches of this amount occurred in three intense showers on the 22d and 23d. The runoff on the various areas was: W-I, cultivated, 1.65 inches, W-II, pasture, 1.01 inches and W-IV, mixed, 0.91 inch. The cover for W-I at this times was mostly wheat, but the other areas had a high percentage of hay and pasture.

"Precipitation at Fennimore for the month was 4.41 inches. Of this total, 2.80 inches occurred on the 8th. The runoff on W-I and W-IV was about 0.15 inch. Temperatures varied from a maximum of 87 degrees on the 27th to a minimum of 44 degrees on the 5th, with a mean for the month of 67 degrees or about 5 degrees below normal.

"A heavy rain storm occurred on the night of July 21 in Vernon and Richland counties in western Wisconsin. The precipitation at Viroqua for a 24-hour period was 8.3 inches, most of which was supposed to have occurred in a 4-hour period. A number of erosion control dams and spillways in the area were examined following this storm and found to be generally in good condition after having carried discharges

approaching their designed capacity. An attempt was made to estimate maximum rates of runoff on some areas from the high water marks either; above and below bridges, or in locations where reasonably uniform cross sectional areas existed for sufficient distance to obtain a good figure on the drop in water surface. Computed peak rates of discharge on areas investigated in this manner were:

665 acres, 1,000 cubic feet per second
1,750 acres, 1,800 cubic feet per second
2,250 acres, 2,750 cubic feet per second
4,600 acres, 5,000 cubic feet per second

"The crop damage in three counties in this area was estimated at 4 million dollars. There were 42 bridges washed out in Vernon County alone. Damage to villages and cities on the lower Kickapoo River was very serious. Six lives were lost when one house was swept away about a mile below the 2,250-acre area shown above.

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minnesota.-"The drop inlet spillway utilizing a pipe to convey water through an earth dam is also known as a pipe bleeder or pipe outlet. The study was initiated in 1942 but has been active only intermittently since that time.

"The accomplishments to date are: The verification of the laws governing extension of the small scale model results to practical sizes, the determination of the laws governing flow through this type of spillway, and the development of methods for presenting the results and computing the flow through field structures. It is hoped that it will be possible to prepare a report covering these accomplishments during the coming winter.

"Briefly stated, there are two equations that determine the flow. The flow over the drop-inlet crest is given by the weir flow equation

$$Q = c\, L \sqrt{2g}\; H^{3/2}$$

where Q is the discharge in cubic feet per second; c is a coefficient; L is the crest length in feet; $g = 32.2$; and H is the head over the crest in feet. The flow through the structure when it is completely full is given by the equation

$$Q = \frac{\pi D^2}{4} \sqrt{\frac{2g\,(H + Z)}{K_r + K_o + f\frac{\ell}{D} + f_r \frac{\ell_r}{4R_r} \left(\frac{A}{A_r}\right)^2}}$$

where D is the diameter of the conduit in feet; Z is the difference in elevation between the crest of the drop inlet and the center of the pipe outlet in feet; K_r is a loss coefficient for the riser and barrel entrance; K_o is the exit loss coefficient (usually taken as 1.0); f and f_r are the friction coefficients for the barrel and riser; ℓ and ℓ_r are the lengths of the barrel and riser in feet; R_r is the hydraulic radius of the riser in feet; and A and A_r are the areas of the barrel and riser in square feet. In use, the discharges are computed by both formulas--the lesser discharge for any given head being the actual flow through the

structure assuming that certain minimum conditions have been met. Some of these conditions will be mentioned later.

"All of the dimensions or variables appearing in the equations, with the exception of K_r and the possible exception of c, can be determined either from the structure itself or from handbooks that are readily available. Values of c for the tests reported here have not yet been determined for various types of drop inlets but can be estimated from published information. Values of K_r for certain types of drop inlets have been determined and will be presented. Future studies will probably be confined to a determination of c and K_r for various types of drop inlets now in use or proposed for use.

"To continue our report of progress, the reanalysis of data obtained from tests made on 17 different arrangements of 6-inch vitrified clay tile pipe in 1942 and 1943 was completed, but the computations have not yet been checked. This reanalysis was begun a year ago but has been delayed by the necessity of completing computations and reports on the box inlet drop spillway study. It does not seem advisable to report results of this reanalysis until the data have been checked, and this may take some months considering the available personnel and the current work load.

"The analysis of the data obtained from the tests conducted between January 1 and June 15 of this year was completed and checked. These tests were made on pipes having the barrel on a slope S of 30 percent. In each test, the riser was square in plan and the edge of the crest was square. The entrance to the barrel was also square edged. A headwall was located along the downstream side of the crest. This headwall was, in terms of the barrel diameter D, 2D high. A dike extended from the headwall to the downstream end of the test channel to prevent circulation in back of it, because tests with the dike omitted had shown that unpredictable results were obtained if circulation in back of the headwall was permitted. The tests are summarized in the following table where Y_1 is the depth of the riser, D_1 is the length of one side of the riser, and h_v is the velocity head in the barrel.

Series	Y_1	D_1	K_r	Minimum pressure
L-20	2.0D	1.25D	0.97	$-1.30\ h_v$
L-21	4.0D	1.25D	.87	$-\ .95\ h_v$
L-22	3.5D	2.0D	.61	$-\ .78\ h_v$
L-23	3.5D	1.5D	.74	$-\ .88\ h_v$
L-24	3.5D	1.0D	1.31	$-1.44\ h_v$

"The minimum pressure in the barrel is measured from the hydraulic grade line and occurs near the barrel entrance. It is given because under some conditions pressures may be so low as to cause cavitation. The theoretical minimum pressure for a square-edged entrance is $-1.27\ h_v$. Although some values of Y_1 used in the tests are lower, Y_1 should be at least 5D in order to insure that the barrel will flow full if the entrance to the barrel is square edged. It may be possible to decrease Y_1 if the barrel entrance is rounded or if the groove entrance to concrete pipe is the barrel entrance, but how much Y_1 can be reduced is not known at the present time. Indications are, as will be discussed later, that Y_1 can be reduced to 2D or less.

"For comparative purposes, the following results are selected from previous tests. Each drop inlet was of the type just discussed but was 1.25D square and 5D deep. The variation is in the slope of the barrel.

Series	S	K_r	Minimum pressure
L-14	0.025	1.09	-1.34 h_v
L-15	.05	.96	-1.15 h_v
L-16	.10	.80	-1.21 h_v
L-17	.20	.80	-1.21 h_v
L-18	.20	.87	-1.01 h_v
L-19	.30	.84	-1.06 h_v

"A series of tests using the type of circular riser employed in the Johnson and Lafayette Soil Conservation Districts of Missouri was begun on June 16. The initial test program was completed on July 31. Nine variations were tested and the results were analyzed, except for certain photographically recorded data that have not been returned from the Regional Office. The test conditions and a brief summary of the results follows:

"The prototype barrel diameter D was 24 inches (model diameter was 2-1/4 inches). The barrel slope S was 20 percent. The entrance to the barrel was formed as if by wrapping sheet metal around the outside of the barrel and extending it to the inside riser form. The groove end of the concrete pipe was not filled in. The inside base of the riser was at the elevation of the pipe invert at its entrance. The riser depth was 4 feet or 2D.

Series	Riser dia.	Crest of riser	Baffle	K_r	Minimum pressure
L-25	42.7 in.	Square edged	A - 18 in. high	0.66	+0.12 h_v
L-26	Same	6 in. radius	None	.42	+ .07 h_v
L-27	Same	Same	A - 18 in. high	.42	- .02 h_v
L-28	Same	Same	B - 18 in. high	.50	+ .11 h_v
L-29	Same	Same	D	.46	+ .13 h_v
L-30	30 in.	Square edged	C	1.06	- .12 h_v
L-31	Same	6 in. radius	A - 18 in. high	.62	--
L-32	Same	Same	E - 18 in. high	.72	--
L-33	Same	Same	A - 48 in. high	.61	--

"Description of Baffles:--"Baffle A - A splitter wall, 5-1/ inches thick, was located on centerline of riser parallel to barrel. It extended from 9 inches upstream of the inside of the riser downstream into the dam. Baffle B - The wall was tangent to the inside of the riser and was 7 feet long. Baffle C - The 9-inch thick riser walls were extended 30 inches above the riser crest. The upstream half of the extension was cut away from the riser crest to 18 inches above the crest. Water entered the riser both through this cut-away portion and through the top of the riser extension. Baffle D - This was a circular cover 8 feet, 6 inches in diameter set 18 inches above the riser crest. There were three support walls, 30 inches long by 5-1/3 inches thick, set radially at 120° to each other. They extended from the circumference of the cover to the inside of the riser. Baffle E - A splitter wall,

5-1/3 inch thick, was located on centerline of the riser parallel to the barrel with the top of the baffle flush with the riser crest.

"None of the results presented here should be applied without a greater knowledge of the flow conditions than can be given in the available space. Nevertheless, some discussion will be presented.

"Series L-14 to L-19 - The riser was deep enough so that there were no fluctuations in the headpool level as the barrel alternately flowed full and partly full at intermediate discharges. There was some vibration of the pipe due to the sucking of air through the structure. Air suction continued until the barrel flowed completely full.

"Series L-20 to L-24 - The riser was made short enough so that the headpool would fluctuate and indicate the minimum depth of riser that could be used. With the shorter risers, the entrance to the pipe at the foot of the riser acted as an orifice at certain stages and discharges. This caused the headpool to rise until the head was great enough to cause full pipe flow. The headpool was then drawn down until air was sucked in and the barrel flowed only partly full. The cycle was repeated indefinitely. With the deeper risers, the fluctuation in the level takes place in the riser instead of in the headpool. In the case of detention storage structures, the presence of orifice flow might cause much of the storage space in the reservoir to be used up prematurely and become unavailable for taking the peak off of the hydrograph.

"Series L-25 to L-33 - These tests were made to study the performance of a circular riser and to study headwalls for vortex elimination. Series L-25 had a Type A headwall and vortices were not present until the headpool level covered the headwall. Series L-27 was similar, except the riser crest was rounded. Series L-31 was similar to L-27, except that the riser diameter was decreased.

"Series L-33 was similar to L-31, except that a higher baffle was used. For the lower baffles, vortices appeared when the headpool level submerged the baffle. This permitted air to be gulped into the structure caused vibrations. The higher baffle of Series L-33 reduced this vortex formation greatly and improved the shape of the rating curve to the point where the discharges could be reliably predicted. Series L-26 was made with no baffle and showed definitely that some form of baffle is required. In Series L-28, water was permitted to circulate between the baffle and the end of the test channel. This aided vortex formation. Indications are that prevention of circulation, as in Series L-14 to L-24, and a higher baffle would be satisfactory, but Baffle B does cut off free access to more of the riser crest than does Baffle A. Baffle D was used for Series L-29 and proved the most satisfactory of those tested. However, it was only slightly better in performance than Baffle A used for Series L-33. Baffle E used for Series L-32 does not prevent vortex formation. It appears that the baffle must be possibly 2D high or extend above the water surface to prevent vortex formation. The proper baffle height remains to be determined. Once formed, vortices prove difficult to destroy. Baffle C used in Series L-30 was a poor performer and caused more vibration than any other type tested. The high value of K_r is an indication that its losses are high.

"It is to be noted that each of the circular risers was 2D deep and that the barrel entrance was the groove entrance of a concrete pipe. In the cases of Baffles A, B, and D, there were no headpool fluctuations and the transition from weir control to pipe control was abrupt and satisfactory. In order of performance, Baffles D, A, and B are recommended in that order. However, it is doubted that Baffle D is enough better than Baffles A and B to warrant its use if cost is the only consideration. Baffles A and B should be designed for full hydrostatic head on one side and

no head on the other side to eliminate the possibility of their tipping over. The vacuum under Baffle D was not measured but appears to be not high. More work on this baffle is in order if it is to be given serious consideration in the design office, in order to determine optimum sizes and design vacuums.

"Mr. Donnelly spent the week of July 16 in Eastern Illinois inspecting drainage structures with members of the Regional Office and the State Office staffs. Particularly noted by him was the scour which occurs upstream from the drop spillways and duplicates the scour observed in the models. This scour is deep enough so that it might undermine the wingwalls if they are not extended deep enough. Another disturbing feature was the way in which box inlet drop spillways are constructed. The fill is pushed too close to the sides of the box inlet, cutting off free access to the sides and greatly reducing the available capacity. This undoubtedly contributed to the failure by overtopping of one of th se structures. This improper location of the fill has been noted in most field structures and is not confined to Illinois. It seems likely that the field inspectors do not realize the great importance of seeing that structures are installed in every detail as shown on the plans. Some means must be found to correct this, possibly through education of the field men as to what is important and why."

Hydraulic Studies - D. A. Parsons, Minneapolis, Minnesota.-"The activities in the Coshocton-type runoff sampler included:

1. Revision of plans (Drawing 3-P-26003) for Model N-1, 1-foot diameter sampler units, to improve starting.

2. Initiation of contract amendment for 18 units to reflect these changes.

3. Initiation of procurement of four Model N-2, 2-foot diameter sampler units.

4. Construction of one experimental Model N-2 in the St. Anthony Falls Laboratory shop.

5. Preparation of drawings for Model N-2:

   (a) Construction details for sampler.
   (b) 1-foot H-flume plans.
   (c) Support for N-2 unit.

6. Trial of Fafnir, Type RBGF, rubber flange cartridge as an alternate for the inch-series shielded bearing in Model N-2.

7. Measurements of the moments of inertia of Models N-1 and N-2, and comparison of the experimental values with the requirements for dynamic similarity.

8. Hydraulic tests of the experimental N-2 sampler to determine:

   (a) The necessary and sufficient wheel weight and moment of inertia of N-2 to insure turning at maximum flow.

   (b) The adequacy of collecting pan design from the standpoint of loss of sample by splashing.

(c) The effect of a small change in wheel elevation relative to the approach flume.

(d) The effect of a change in the divergence of the side plates of the sampling head forming the slot edges.

9. Transcription of test data, preparation of sketches, and revision of the text for a report and record of the experimentation in this study."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.-"Mr. Daniel and I have been planning the installation and operation of the runoff studies at Cherokee and Guthrie. We have run into problems which relate to the volume and cost of the work proposed. The amount of work is shown in the following tabulation:

Station	Study	Flumes or gages	Flumes to be built
Cherokee	A Plots	60	28
	B Plots	32	16
	Watersheds	9	0
	Humidity	1	
	Rain gages	10	
		112	44
Guthrie	Crop rotations	6	6
	Pasture	11	10
	Big Watershed	1	0
	Humidity	1	
	Rain gages	14	
		33	16
Total of recording instruments			145
Total number of flumes to be built			60

In a year of average rainfall experience Mr. Daniel estimates that the 145 instruments will yield a total of 5,114 charts

"The first item considered is the installation of the new flumes. While many of the old flumes can be salvaged there are still 60 new ones to build.

"The next item is the handling of the records after they are collected. Mr. Daniel estimates that this will take two people full time to do the work.

"We have built the pipe outlet experiment which was financed largely by flood control design funds. It will be ready for testing next month. The setting up, testing, and revising of this experiment alone will keep the staff busy for two more months. In addition to installing this experiment we have put in three watersheds using existing culverts for measuring devices. We are working out the techniques of this type of research and plan to get into the large size areas on which Operations need information. Recently Mr. Coyle has asked for experiments and data on curved, vegetation-lined spillways. I have worked up a proposed experiment to provide some of the data."

Drainage Studies - J. C. Stephens, West Palm Beach, Flordia.-"During the month loading tests were conducted on the Diesel-electric generator in the pump house at the Everglades Experiment Station, using a crock of brine with water pipe electrodes as a load. During these tests, current and voltage values were carried to 200 percent and 125 percent of rated values, respectively, and the generator was in operation for a total of 5 hours. It is felt that this generator unit will be capable of delivering a certain 35 h. p. to motor leads and may, with power factor correction using condensers, develop as much as 50 h. p. at the motor leads.

"A bulldozer was borrowed from the Central and Southern Florida Flood Control District and approaches made to the canal bank crest at intervals between the north to south farm laterals that cut the bank into three segments along the selected stretch. The 'dozer was then used to clear the canal bank crest of fallen trees and debris for the entire length of the stretch to facilitate the use of spraying equipment. Care was exercised in the use of the 'dozer to leave the native growth of para grass undisburbed.

"One hundred-foot stretches were laid out along this site, with a 50-foot space or 'balk' between each 100-foot stretch. As 16 different treatments previously had been decided upon in organizing the tests, the first 16 plots were laid out as the 'A' group, and were numbered consecutive 1-A through 16-A. Each of the 16 treatments was made 3 times in the length of the stretch to insure the best results should rainfall or other factors influence the effect of any one treatment. To protect the repeated treatments from being influenced by the same factors, such as wind action and possible 'contamination' from preceding treatments, the remaining 32 plots were randomized as to location in relation to each other. The second series of treatments was called the 'B' series and was numbered 1-B through 16-B, and the third series was called the 'C' series and numbered 1-C through 16-C. Though randomized as to location in order of sequence, the repeated treatments were identified by the numerals, for example; Plot 12-B and Plot 12-C received the same treatment as 12-A regardless of location.

"After laying out the 48 plots as described, it was determined that the average distance from the water's edge to the portion of the canal bank that was not infested with para grass was 35 feet. To hold the plots to the same area, each plot was laid out 100 feet long by 35 feet wide, or approximately 0.08 of an acre.

"A recording rain gage was installed on the canal bank 1 week prior to spraying, and a continuous record of rainfall has been kept to ascertain the effect of rainfall on the efficiency of the treatments.

"Arrangements were made through the Flood Control District for a commercial spraying company to apply the herbicides. Spraying was accomplished with a John Bean high-pressure pump with Briggs & Stratton motor, mounted on a Willys 1/4 ton Jeep and equipped with a 50 gallon tank with agitators.

"Prior to spraying, Kodachrome color pictures were made of each plot to give an idea of the condition of the para grass prior to treatment. Plots were identified on each picture by holding within the range of the camera a large blackboard on which the plot number had been chalked. The same procedure will be followed in recording the effects of the different treatments."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"Showers were recorded on 14 days in the southern, central, and northeastern portion of the area and 22 days in the western portion.

"The average rainfall for July this year is 9.57. From records since 1946 this is slightly above average for this month. In 1950 the average was 7.9; 1949, 8.87; 1948, 7.4; 1947, 11.5, and 1946, 9.3.

"In connection with the nitrate leaching studies, samples collected during this period show that showers were recorded on 15 days with rains of over 2 inches on July 10 and July 14. Samples collected prior to July 10 showed little or no loss but samples collected immediately following showed losses ranging from 40 to 90 ppm. Samples collected during the latter part of the period showed that for the plots on which more inert types of nitrogen are used there has been a build-up of nitrate nitrogen. On those plots where more soluble types are used there has been little or no build-up. It is hoped that the results of the studies of this series of plots will give information on the relative value of maintaining a constant level of nitrogen as against a fluctuating level.

"With rains occurring nearly every day moisture readings have remained low during all of this period. Visual inspection of the plot areas indicate that the plots receiving water when indicated throughout the year by our moisture meter readings contain trees which are in better physical condition than those of any of the other plots. Analysis of samples collected from these plots show that the amount of water soluble phosphorus was higher than that of the other plots."

Drainage Studies - T. W. Edminster, Blacksburg, Virginia.--"Mr. Walter Turner reports that he and Mr. R. R. Covell, Regional Office Soil Scientist, and John W. Clay, Survey Supervisor, visited 18 permeability sites for the purpose of post correlation of observable field characteristics with degrees of permeability.

"Increased demand for information concerning field moisture relationships have prompted the consideration of including in the permeability reports data as to the 'water remaining' after 15 hours of drainage under 60 cm of tension. This value would be reported in cc per hundred. Also if desired, percentage by weight for field capacity and available moisture-holding capacity could be estimated by the additional use of the volume weight given.

"In Mr. Turner's report for August 1950, he showed an equation for estimating moisture equivalent from the percentage of moisture by weight after 15 hours of drainage by substituting the relation between cc/100, volume weight, and percentage by weight the equation becomes

$$M.E. = -3.5 + 0.98 \left(\frac{(cc/100)}{(vol.\ wt.)}\right)$$

"An important advantage of using cc/100 is that it is more basic than an estimate of field capacity as the latter can be modified.

"In his report for October 1949, it was shown that available moisture-holding capacity could be calculated by multiplying the field capacity by 0.4565. Using this factor in the first equation another one for available moisture-holding capacity follows:

$$A.M. = -1.6 + 0.45 \left(\frac{(cc/100)}{(vol.\ wt.)}\right)$$

"Mr. Walker returned from his detail to Maryland on July 2. He reports that 'Most of July 2 was devoted to discussion with C. S. Slater, SCS, Beltsville, Md., R. H. Brown and Robert W. Stallman, USGS, Washington, D. C.

"Mr. Brown pointed out that the pump draw-down well should pass through the entire acquifer to the aquiclude. When well does not reach through the aquifer, a correction must be applied to account for the water that rises and enters the well as head decreases. Mr. Stallman has worked with open ditch drainage in portions of the Ohio Valley. Based on that work he has developed a method of calculating the most effective spacing of ditches in those soil conditions. So far this material has not been published.

"Mr. Slater discussed the depth-spacing formula which was presented in September 1950 Agricultural Engineering. Both he and Mr. L. A. Jones expressed the desire that this formula be tested with the data collected in Virginia. It is understood that the formula is being used extensively in Region III and in some of Region I.

"Following Mr. Slater's suggestion, the formula, $S^2 = \frac{4P(b^2 - a^2)}{V}$, was solved for 'V.' Values for 'a' and 'b' were taken from tile draw-down tests and 'P' from the data reported by the Permeability Survey. Values for 'V' as computed in the Slater equation were compared with values for 'V' as computed from observed draw-down curves by dividing the observed draw-down at the midpoint between tile laterals by the soil porosity in percent. There was no observable correlations of results from 64 observations.

"In an effort to check the raw data against some other method of analysis, the equation being developed by this project was solved for permeability, 'P', and the results compared with those reported by the Permeability Survey. The following table gives the results of the first three tests. The data are arithmetical averages which have not been subjected to statistical analysis.

Location	Soil type	Minimum permeability in profile		Ratio (approx.)
		By core sample	By water-table draw-down	
W. R. Harrell	Bladen very fine sandy loam	0.13	0.160	1/1
J. E. Rawls	Moyock fine sandy loam	3.38	.352	10/1
S. W. Lee	Moyock fine sandy loam	10.24	.257	40/1

"Arrangements are being made to carry this study further. All computations thus far are based upon permeability determinations with cores taken vertically. As soon as data from cores taken horizontally are available, they will be incorporated in the analysis. Methods of statistical analysis will be applied to final computations."

Supplemental Irrigation Studies - J. R. Carreker, Athens, Georgia.-"Wm. B. Land reports the climatic observations for July included: Rainfall - 8.06 inches, or 3.02 inches above normal; evaporation from the pan - 7.71 inches;

wind movement - 436 miles; maximum temperature - 99°F. on July 14; minimum temperature - 52° F. on July 8.

"There was an excess of rainfall at the beginning of the month, a deficiency during the second and third weeks and an excess the latter part. All crops under study were irrigated during the period of July 10-24.

"Yield records were being obtained at the end of the month on the string beans, tomatoes, pimento peppers and sweet corn. No final data were available, but it was apparent that the quality of these crops was considerably improved by irrigation.

"Professor Carlisle Cobb, Jr., of the Agricultural Engineering Department began a study of the quantity and distribution of tomato roots in the three levels of irrigations on the vegetable plots.

"The week of July 23-28 was devoted to a planning conference for the research studies at Athens and Watkinsville. The irrigation studies were included in these discussions. Our present program of study was outlined in detail. Additional studies suggested included:

1. Determine the water yield from small watersheds of 2 to 1,000 acres in size, to know how much area is required for a satisfactory supply.

2. Obtain information on the depth of roots of different crops.

3. Determine the consumptive use factor for different crops in the Southeast.

4. Make field observations on the efficiency of use of irrigation equipment.

5. Study the use of drought resistant plants in our cropping systems along with the irrigation studies.

6. The efficiency of use of the water supply should be emphasized."

Supplemental Irrigation Studies - T. W. Edminster, Blacksburg, Virginia.- "The rainfall for the month was approximately 3.71 inches. The third application of 1.5 inches has been completed on the two irrigated pasture lots. The two irrigated lots have provided a great deal more herbage this past month then the check lots. The number of steers in Check Lot No. 4 was reduced to five to provide sufficient grazing for the remaining animals.

"A survey of the four pasture lots was made to check their present areas and to determine the most satisfactory locations of the ladino-orchard grass areas to be seeded in each pasture lot. After eliminating the swampy land and poor watering conditions now existing, the area in each lot was adjusted to 8 acres. One third of this area in each lot has been plowed and disked in preparation for the seeding of ladino clover and orchard grass.

"To minimize the watering and shade problems next year for the steers, the ladino areas in Lots 1 and 2 were located adjacent to the division fence of Lots 1 and 2, running the full length of the lots. The ladino areas in Lots 3 and 4 were located similarly along the division fence of Lots 3 and 4. Next year, watering tanks will be located near and filled from the irrigation main in each lot and some provision will be made for artificial shade.

"On the irrigation control plots the second cutting of alfalfa was sampled on July 9 and two applications of 1.2 inches of water have been applied to the stubble. The wheat samples were harvested on July 3 and the young clover in the wheat stubble has been irrigated. The corn and burley tobacco plots have also been irrigated. Hail damaged the tobacco on July 29."

Sedimentation Studies - L. M. Glymph, Jr., Lincoln, Nebraska.-"The first week of July was spent with Mr. L. C. Gottschalk, representatives of the Geological Survey, and representatives of the Region 5 Water Conservation Division on field reconnaissance in portions of the Cheyenne River Basin in Wyoming and South Dakota above the Angustora Reservoir. This reconnaissance was made for review of sedimentation studies currently being made in that area by the Geological Survey. A request by the Washington office of the Geological Survey for Mr. Gottschalk to collaborate with their field personnel led to arrangements for the reconnaissance. It provided an excellent opportunity to become better acquainted with the sediment problems and extensive activities of the Geological Survey in that part of the Missouri River Basin.

"Ten days in the latter part of the month were spent working with the Region 5 Water Conservation Division on a special report of the Kansas floods. A brief field trip was made for the purpose of obtaining impressions of the extent and nature of scour and deposition in the flood area. A number of photographs were taken and other data assembled for use in the report."

Sedimentation Studies - R. Woodburn, State College, Mississippi.-"The week of July 16 to 20 was used for a Research-Operations field study and conference. This activity is covered by a special report which appears below:

"As outlined in this special report it seemed desirable to utilize the ponds of the sedimentation survey group for some additional work. We have a fairly complete record of watershed conditions and we know size of ponds and size of drainage area. It was thought that some hydrologic information could be found by studying the spillways on these reservoirs as to size, design, adequacy, etc. I am definitely coming to the opinion that we may be penalizing our Flood Control program by insisting on spillways wider than necessary.

"Let us study this series of 23 ponds for spillway size and see what we discover! Accordingly, Mr. Burford was detailed to the field for July 25 and 26 to start the spillway measurements which will be completed shortly.

"Mr. R. Y. Bailey of the Regional Office spent Monday morning, July 16, with us at State College in some general research problem discussions and in calling upon Professor Henry H. Leveck, newly appointed Associate Director of the Mississippi Agricultural Experiment Station.

"We proceeded to Oxford and shortly after noon met Mr. A. C. Allnutt and Mr. A. R. Burford of the Flood Control office for a detailed inspection of the problems in Goose Creek. As noted in a previous report, Mr. Anderson, a landowner in East Goose Creek valley, had dredged the channel of this creek through his property where it had been sanded full. It was our desire to use this newly opened channel somewhat as a field laboratory to determine the behavior of a channel excavated in unstable materials and furthermore to observe channel behavior below proposed sand traps. We found that unfortunately this area had suffered a very intense rain on Saturday, July 14, and this rain had created a great deal of damage to landowner Anderson's ditch. The spoil bank which was used as a dike to increase channel capacity was

completely destroyed in several places with gaps 100 feet long created. It will be very difficult to make the measurements which we desire to make if the water coming down this valley is not confined to one channel.

"Dr. Ray J. Nichols, Professor of Anatomy at the University of Mississippi and observer for the Weather Bureau, gave us the following report on this rain:

4:15 p. m. to 4:30 p. m.	0.15 inch
4:30 p. m. to 4:45 p. m.	1.80 inches
4:45 p. m. to 5:00 p. m.	.65 inch

"The rain then continued until 2.87 inches had been received by 6:00 p. m.

"According to Yarnell's tables, this is equal to the 100-year expectancy for 15 minutes. This is equivalent to Yarnell's 50-year rain for a 30-minute period.

"An attempt will be made to salvage as much of this study as possible in spite of the damage of this unprecedent storm.

"On Tuesday morning the group consisting of Mr. R. Y. Bailey, Mr. A. C. Allnutt, Mr. A. R. Burford, Mr. James B. Burford, Mr. W. L. Heard and myself met at the Flood Control office in New Albany for an orientation discussion before going to the field for the remainder of the week. High points of this discussion included the need for soil studies to understand the characteristics of the soil profile in order to be definitely sure that trees and other vegetation promote increased water intake. Vegetation, of course, protects the surface and does generally increase water-intake rates. Unless, however, there is considerable space above an impervious stratum, there cannot be a great deal of storage. There was also emphasized the great need for runoff data for areas of 100 acres to 100 square miles.

"All Tuesday afternoon was spent in an inspection of the area in the Upper Tallahatchie and in Cane Creek above New Albany. We saw one of the 10 drop-inlet detention dams built about a year ago. This structure features a corrugated metal drop pipe with an emergency spillway. It appeared that much of the sand produced by the watershed will be caught by the broad valley above the dam and may not get to the cross-sectioned area near the pool for a long period of time. This was a very fine looking structure showing evidence of careful design and construction, but some question was felt as to the adaptability of the structure to the area. We also saw a 50-acre drainage area with one of the older small sand-trap dams with about 10 acres of active Pontotoc Ridge gullies. It appears that this dam will soon be sanded with sediment probably before the trees planted in the gullies can be affected. This structure was built before the monumented gully rate of 2 inches per year of sediment from gullies was made available. We also examined several areas of Pontotoc Ridge gullies with the idea of comparing this material with the Lafayette county gullies with some type of splash study.

"Wednesday morning the entire group visited East Goose Creek for field examination and to outline general sediment problems. It was pointed out that sanded valleys are not necessarily ruined for agriculture if further sand deposits can be handled either by complete shut off in the head waters or by some type of directed aggradation.

"A visit to Hudson Creek pointed up the problem of channel meandering. Is it possible to identify the reason for channel meanders? Is meandering inevitable? There is need for a study comparing caving banks of a stream with noncaving banks in the

attempt to isolate the reasons for such caving. Is the caving a matter of the material in the bank or a purely hydraulic question? What part does the sediment load carried by the stream have in channel meandering? It was pointed out that all streams in geological old age apparently suffer from the meandering condition. Are we going against nature in attempting to control banks? If so, are we justified in doing this in order for the landowners along such caving sections to enjoy at least some years of use of the land? Many of the small and medium size bottom land fields are made unuseable by the continuous unpredictability of the streams through bank caving and meandering.

"We visited Longwood to see pine interplantings in hardwood on blackjack ridges. There was a general feeling that the land use would be improved by the pine taking over the blackjack ridges and a better type of cover on these areas would improve water intake characteristics.

"Wednesday afternoon the gullies on the Berkeley Mitchell place were visited and we discussed the debris dams which are now under measurement. Several of these basins were cross sectioned in July 1949 immediately after construction and were recently cross sectioned again. We are now in the process of calculating the sediment produced in that 2-year period. We are hoping to compare the material in these gullies with the Pontotoc Ridge gullies by means of some splash studies.

"Mr. Allnutt measured the slope of sand deposits above some of these little ponds. He found the sand standing on a 3 percent slope near the water and approximately a 5 percent slope 50 to 100 feet from the water of the pond. The kudzu planted in the spring of 1950 on these gullies was very good as it had had a booster shot of fertilizer in the spring of 1951.

"The older debris basins on the Hamilton place and the degraded channel below were inspected. This kudzu planted in the spring of 1949 looked very good.

"A stop was made at Splinter Creek on the road bridge below the long flat sand plug area. Question: How does this compare, or contrast, with East Goose Creek? We also saw this channel as it entered the valley of the Yocona River where it was well open to a depth of 15 feet with no evidence of sanding.

"We saw the 1948 kudzu area on the Tatum place on the upper Splinter Creek watershed. Question: How about extra shot of fertilizer on kudzu 1 year after planting? This was thought desirable but could be done more cheaply by giving extra fertilizer at planting time. We saw pine planted in several gullies visited and this was discussed as to survival on dry hot gully slopes. Some of these areas will apparently not support a pine planting, except on a selected planting site.

"Thursday morning we visited the first crossing of Hickahala Creek east of Senatobia just above where the Army clean-out work stopped. A plug starts above this point and goes almost to the mouth of Jim Wolf Creek. Jim Wolf Creek is a heavy sand carrier with about a 60-foot wide flat sandbed and extremely eroded watershed. The Army Engineers and Flood Control are cooperating on a $70,000 project starting at once to clean out Hickahala Creek through the sand-plug area. It was proposed that Operations and Research and Army Engineers should all join hands in an extensive study of the whole matter of stream behavior on this channel. It appears that the channel is now cleaning below plug on account of sand dropped in the plug above. Agriculture is greatly restricted in Hickahala Creek at this time on account of sand plugs, break outs, and secondary flooding.

"We visited the location for a drop-pipe detention basin south of Highway 4 and 2 miles east of Thiatira.

"In the afternoon we visited the site of Arkabutla Creek for a proposed $28,000 drop structure. The overfall in this channel has advanced about 1,000 feet since we observed it 2 years ago. The channel is about 50 feet wide and 15 feet deep, and the drainage area is only about 12 square miles.

"We then proceeded to Charleston in Tallahatchie county and viewed North Tillatoba Creek on the northwest side of town. Here again is a wide sandbed channel with excessive meandering. Here the question arose again, what is the relationship of sand carrying and meandering? East of Charleston on Highway 32 South Tillatoba Creek was inspected at a new pipe line crossing. Here we found sloping banks with a very rough covering of vegetation and little evidence of sand. This channel changes appearance entirely within a mile or two downstream to wide flat sandbed and caving banks. What causes this difference in behavior? We visited the same channel about 2 or 3 miles further upstream where the channel is in excellent shape and well stabilized.

"Friday morning a stop was made on Wilkins Creek about 3 miles west of Duck Hill. At this point, a number of years ago the CCC forces installed brush jetties and planted a great deal of kudzu. According to the landowner, Mr. Stark, this work had been very effective except for one pronounced meander just south of the county road. This looked bad although it did not appear to the group that such efforts were by any means fruitless. It was the belief of the party that a job such as this is never entirely done but must be watched and reinforced and helped along. On any of the streams in this section, it appears that you cannot just finish any type of job, pronounce a benediction, move out and never see it again.

"The remainder of the morning was spent in observing Big Sand Creek near McCarley and Carrollton and comparing it with Black Creek in the vicinity of Lexington. There was still the idea in the minds of some members of the group that these channels were behaving differently. It was felt that a detailed study should be made to find out if differences really occur, and if there are differences in bank stability, etc., an attempt should be made to isolate reasons for such differences. Personally, I am inclined to wonder if there are any outstanding difference between Big Sand and Black Creek if the streams are considered in their entirety. We undoubtedly find caving bank sections and meandering on each stream and reaches of comparative stability. It does, however, appear that Black Creek is not quite the problem that Big Sand Creek is.

"In the afternoon we visited several corrugated metal flume drop structures on Highway 12 east of Lexington. These structures are for the purpose of preventing overfalls coming back into the fields where field water must enter a deep and caving channel. Later in the afternoon the party met in the work unit office at Winona for a recapitulation of the week's activities and for making some record of the problems and what might be done about them.

"The offer by Dr. Ray Nichols, University, Miss., was presented to the group in which he proposed to offer his pond for calibration and measurement with the idea of runoff studies in the same area where he maintains his weather station. It was decided this area should be inspected, and if suitable, something further would be done. It was also suggested that a detailed study be made of the outlets and spillways of all of the reservoirs used in the sedimentation study. (Research personnel are now attempting to collect data necessary for studying these spillways and this

will be correlated with the existing watershed information now available.)

"The following four suggestions were made:

---- Research Suggestions --- Tallahatchie-Yazoo Watershed --

1. Activities which can be carried on as formal projects on current MS-R-2.

   Example: The monumented gully studies and sand-transport investigations.

2. Activities which can be carried on by MS-R-2 personnel, based on items which can be set up cooperatively with Operations primarily as systematic observations of operations now in progress.

   Examples: Measurement of debris basins, channel observations in East Goose Creek, observations of changes that occur in channels and flood plains as a result of watershed treatments (Hickahala Creek).

3. Systematic observations of specific problems or established practices in order to segregate guiding principles or evaluate the practices. These may be carried on independently by MS-R-2 personnel or cooperatively with Operations personnel.

   Examples: Factors determining the behavior of streams. Why do individual streams behave differently? Study the effectiveness of a complete cover of kudzu in stream-bank stabilization. Study the influence of cultivation, fertilization, or other treatment on the rate of development of a kudzu cover. Study the rate of development of cover on areas planted to trees. These observational studies will be carried on in accordance with a carefully developed procedure.

4. New research projects of a major nature.

   Example: Refer to memorandum of November 28, 1949 'Research Needs of Yazoo River Watershed' - A. C. Allnutt, Memorandum of December 15, 1949, 'Proposed Research in Yazoo Watershed' M. L. Nichols."

IRRIGATION AND WATER CONSERVATION DIVISION

Cotton Irrigation Test Studies - K. Harris, and H. B. Peterson, Phoenix, Arizona.-"Work was continued on a cotton irrigation test at Beardsley. Here amounts of water applied and runoff are being measured on a 69-acre cotton field. The following is a summary of irrigations given to date:

	Amount applied Ac. Inch./Acre	Runoff Ac.Inch./Acre	Percent waste
Pre-Irrigation	18.6	9.3	50
1st Irrigation	6.5	2.4	37.4
2nd Irrigation (Irrigated every other row)	4.4	.7	16.2
3rd Irrigation (Irrigated every other row)	5.8	.6	11.0

"The fourth irrigation is now in progress. There has been quite a lot of trouble in this area with wells being unable to supply the demand of the cotton farmer. Consequently, some acreage has been dried up - other fields have suffered in the growth of cotton."

Water Spreading, San Joaquin Valley - L. Schiff, E. S. Bliss, and C. E. Johnson, Bakersfield, California.-"Head appears to be an important factor whose effect varies with the length of column saturated and with the friction factor amongst other things. For example, on untreated soil at three locations a change in head of about 1 foot increased rates from about 0.25 to 0.3 foot per day, from about 0.55 to 0.7 and from about 0.75 to 1.3 Differences in the effect of the 1 foot head increase varied from 0.05 to 0.15 to 0.55 depending apparently on the degree of cloggish or porosity or friction. On spreading areas it may be possible to increase head economically and reduce the size of the spreading area.

"Preliminary analysis indicates only a general correlation between laboratory percolation rate and amount of pores drained at several different tensions. The effect of slaking and entrapped air are difficult to evaluate under the short percolation period used (3 hours).

"Studies of the decomposition rate during 'incubation' of various plant residues in soil are being made. Two soil-moisture levels area used; approximate field capacity and saturation. Thus two distinct decomposition processes are involved. At field capacity the decomposition will be largely aerobic while in saturated soil the anaerobic condition will predominate. The water stability of soil lumps will be ascertained along with the decomposition rate. These determinations will be made at monthly intervals for a 4-month period."

Water Supply - Tehachapi Soil Conservation District - G. M. Litz, Los Angeles, California.-"In connection with the cooperative water-supply study of the Tehachapi Soil Conservation District, the program for the monthly measurement of depth to water in 51 selected key wells was started on July 26. In general, the change in water levels ranged from zero to 10 feet below the level of October 1950. Several farmers in the District are experiencing a decrease in the quantity of water discharged from their wells and some of them have lowered the bowls of their pumps 60 to 80 feet.

"The data obtained from 65 irrigation trials by SCS Operations personnel in 1948 were analyzed to determine irrigation practices for potatoes in the District. Although the size of furrow stream (gallons per minute) and the length of irrigation season varied with different farm operators, it was apparent that it is a common practice to apply a small depth of water, approximately 1 inch, at intervals of 2 to 3 days throughout the irrigation season. Also, the practices in 1948 were much the same as those in use in the 1951 season."

Infiltration Studies - Ventura County, Calif. - V. S. Aronovici and W. T. Gish, Moorpark, California.-"A primary objective of the Ventura investigation is the location of suitable water-spreading sites. Limitations on intake capacity of the soil surface and profile are important factors for consideration. Three types of investigation are possible for this study. First, characterization of the soil profile by means of Uhland cores processed in the Laboratory. Second, field observations by means of a 1-square foot ring infiltrometer. Third, measurement of intake capacities by means of a 1/1,000-acre tank."

"Three relationships are sufficiently obvious to be worthy of comment. First, the large tank and infiltrometers run simultaneously give similar results. Second, infiltrometers observations made when water was not in the large tank are comparable with the Uhland cores. Three, infiltrometers 3 and 4 when run inside the tank without a buffer ring, indicated intake capacities half again as high as observed by the large tank. Without detailing reasons for these results, it is felt that such results are what could be expected. It further indicates that Uhland cores may represent a conservative estimate of the intake capacity of a soil under conditions of water spreading and suggests that infiltrometers will, when using a buffer ring, reflect more closely the performance of large tanks or ponds. Related studies dealing with irrigation have shown that Uhland cores processed in the Laboratory are comparable to buffered ring infiltrometers."

Los Angeles Coast Basin Investigations - W. W. Donnan and H. F. Blaney, Los Angeles, California.-"The final analysis of field and laboratory data connected with the West Coast Basin cooperative investigation has been made and a report in rough draft completed. This study was made under a cooperative agreement with the California Department of Public Works, State Division of Water Resources. The West Coast Basin is an area of approximately 100,000 acres of coastal plain located between Long Beach and Beverly Hills in Los Angeles County. With the rapid expansion of industrial and agricultural use in this area, the underground water supply has been depleted to a point where withdrawal by pumping has caused sea water to move inland and contaminate underground supplies. In order that the State Engineer's office could adjudicate the waters of this basin and make an inventory of present supplies and future safe pumping rates, there was a need to determine the consumptive use of water of the various land use classifications within the Basin.

"Cooperative field studies were initiated in the summer of 1947 and observations have been made periodically to determine depth of rainfall penetration, soil moisture characteristics, and evapo-transpiration. The following tabulation is a summary of the average annual consumptive use in the West Coast Basin for the 18-year period:

Table 1.--Average annual consumptive use of water on irrigated, non-irrigated and incidental areas in West Coast Basin, Los Angeles County, Calif., for the period 1932 to 1950

Land use	Average annual consumptive use	Land use	Average annual consumptive use
	Inches		Inches
Truck crops	27.0	Dry farm beans	11.8
Cut flowers	33.6	Dry farm grain hay	10.0
Grass and lawns	39.3	Dune and beach areas	4.0
Marsh and seep areas	55.6	Native grass and weeds	10.0
Free water surfaces	49.0	Native weeds and brush	11.4

Performance Tests of Well Screens - C. Rohwer, Ft. Collins, Colorado.-"The model study of the flow of sand into wells was continued on a part-time basis during July. Because of the small flows required in the model study special equipment had to be designed to measure the quantities being used. Small orifices were adopted since they seemed to be best suited to measure flows in the range of from 1 to 10 gallons per minute. Four different sizes of orifices were required. They were calibrated by weighing the discharge at different heads."

Study of Seepage in Irrigation Channels - C. Rohwer, Ft. Collins, Colorado- "Observations on the seepage from the rings at the Bellvue Laboratory and at the site near the Poudre Supply Canal were continued during July.

"Two seepage meters were installed in the seepage rings at the Bellvue Laboratory and at the Poudre Supply Plot. One of the meters was of the variable head type developed by the Division of Irrigation and the other was of the plastic bag type used by the Bureau of Reclamation. Simulataneous tests of the two meters showed that the plastic bag meter usually indicated a higher rate of seepage than the variable head meter. The rates indicated by the variable head meter agreed reasonably well with the rates measured in the seepage rings.

"A seepage meter of the variable head type was constructed of clear plexiglass to see whether light had any effect on the readings. This meter was installed in the seepage rings at the Bellvue Laboratory. Tests on the meter indicate that the seepage decreases in the same manner as that found when meters made of metal are used. The tests have not been continued long enough to determine whether the final rate shown will be less than the loss from the seepage rings.

"Well-type permeameters were installed near the seepage rings at each of the plots. A preliminary study of the results shows a wide fluctuation of the seepage rates with the rates gradually increasing at the Poudre Supply Plot where the soil is a very heavy clay. This is contray to what was found last year. The reason for this phenomenon has not been determined.

"Water was turned into the Poudre Supply Canal on July 21 and after the water was shut off seepage rates were measured by noting the drop in the pool formed between two lined sections. The change in the elevation of the bottom of the canal forms a pool 2 feet deep. The tests indicated that there was very little seepage from this section of the canal which is in sandy clay and sandstone. Measurements of seepage were also made in this section of the canal with seepage meters. In most locations the seepage meters showed practically no loss. Why this should be so is

not definitely known but it may be caused by the fact that there is a definite horizontal stratification in the soil and consequently what seepage did occur was in a horizontal direction. Since the meters were set in the bottom of the canal they would naturally show less than that in the horizontal direction."

Irrigation Studies - N. P. Swanson, Amerillo, Texas.-"Rainfall totaling 2.46 inches was received during July. At the end of the month grain sorghum plots that received a 4-inch irrigation on July 20 were growing vigorously. The unirrigated check plots were heading more slowly and lacked turgor. Little available moisture remained in the surface 2 feet of the unirrigated plots.

"Madried clover plots were irrigated on July 18 and 19 with 4-inch applications. Infiltration rates were 0.10 inch or less per hour for the last 2 inches of water.

"Despite heavy losses by shattering due to hail in June, significant differences in yield were obtained from irrigated wheat plots harvested late in June.

Irrigation	Total water applied Inches	Rainfall inches	Total rainfall* and irrigation	Average yield in bushels/acre	Percent increase over dry plots
None	0	11.90	11.90	4.8	0
1 - 4-in.	4.0	11.90	15.90	8.0	167
2 - 4-in.	8.0	11.90	19.90	12.05	251
3 - 4-in.	12.0	11.90	23.90	16.0	333

*4.85 inches of rainfall on May 15 and 16 necessitated draining of the level plots. No other water was lost by runoff. May rainfall was 6.25 inches.

Irrigation Studies - F. B. Hamilton, Lincoln, Nebraska.-"Trial runs to determine stream size were made on the Arapahoe Length-of-run plots. Stream sizes decided upon for the experiment are 1 gallon per minute per 100 feet of row and 0.75 GPM/100 feet. Since the plots are 400, 800, and 1,200 feet long actual stream sizes will range from 3 to 12 GPM.

"Intake rates were low and variable. It appears that a large part of the variability is due to the compaction of the soil by the rear tractor wheel. Observation of rates of advance on rows being irrigated on the remainder of the field seemed to verify this conclusion."

Surface and Sprinkler Irrigation Studies - W. D. Criddle, Boise, Idaho.-"Irrigations were continued on the Black Canyon experimental plots near Caldwell, Idaho during the month of July by Claude Pair and Sterling Davis. Intake rates were measured, both by using rings and by making field checks on intake rates. It was interesting to note that lateral soaking between corrugations occurred within about 24 hours on the downhill plot planted to clover; in other years, it has required at least 48 hours to obtain the same lateral penetration of water. Results indicate that perhaps the intake rate of the soil is improving some."

Irrigation Demonstrations - W. D. Criddle, Boise, Idaho.-"During the month of July, assistance was given Operations and Extension Service personnel in conducting farmer irrigation demonstrations. Personnel from the Boise office assisted in conducting demonstrations in Idaho, Wyoming, and Montana. More than 1,000 farmers attended these demonstrations and expressed considerable interest in the equipment displayed for the control of water, as well as the theory of applying irrigation water properly."

Irrigation Studies - W. C. Barrett, V. E. Hansen, and C. W. Lauritzen, Logan, Utah.-"Barrett reports practical completion of final reports on (a) Consumptive Use of Water in the Colorado River Area of Utah, and (b) The Development of a Power Driven Over-Snow Vehicle. These reports will be duplicated for limited in-Service distribution.

"Hansen reports use of IBM machine running cards for recording irrigation and soil-moisture data from cooperative research project at the Greenville farm makes it possible to analyze the records for 1 day and have it available for use the next day. In this way, all data are kept current and serve to guide the irrigator in supplying the proper amount of water to maintain the required moisture stress. Errors or omissions are also picked up currently.

"Findings of research in irrigation were presented to extension groups, representatives of National Sugar Beet Foundation and others.

"Popular articles for local papers were prepared:

(a) When to Irrigate and How Much Water to Apply
(b) Efficient Use of Limited Water Supply

"Lauritzen reports no satisfactory method for estimating the range of permeability of various soil materials has yet been developed. Both laboratory and field techniques are being studied. Field studies on the Weber-Provo Diversion canal show a general rise in the ground-water table in the vicinity of the canal, but it is not possible yet to say for sure whether this is the result of seepage from the canal or from irrigation water applied on the bench above the canal. Current-meter methods of de-determining seepage indicated losses from the canal.

"The study of seepage losses on the Wilson Irrigation Company canal using 'seepage meters' was continued. Wide variations between measurements for side by side locations are the rule. A serious problem when using 'seepage meters' in sandy materials to determine losses is the scour which undercuts and at times upsets the meter. Baffles of varying design are being tried as a means of preventing this difficulty during measurement.

"The Johns-Mansville Corporation furnished some prefabricated asphaltic lining material for testing. This material consists of 12 lbs. asbestos mat impregnated with catalytically blown asphalt and sanded to produce a 70 lbs. mat. At summer temperatures it is very flexible. This material will be tested to determine its suitability for canal lining.

Irrigation Studies - C. E. Houston, Reno, Nevada.-"Houston reports 'Border irrigation evaluations made in Paradise Valley with the Elko Soil Conservation Service Work Group indicate excessive applications of water on some 800 acres of land on one ranch. This ranch was irrigated by pumping. Measurements indicated that twice as much water was being applied as was needed. The measurements were made on a farm planned by Soil Conservation Service and the recommendations for land preparation were carefully carried out. When it came to irrigating, however, there was no follow up to see that good water management was practiced, and much of the benefit of farm planning was lost. In other words, it is just as important to operate our irrigation plant correctly as it is to build it correctly."

Irrigation Studies - F. M. Tileston, Ontario, Oregon.-"Cooperative experiments designed to determine the effect of sub-soiling and deep placement of fertilizer on root development and moisture penetration were carried out in July on the Malhuer Experiment Farm at Ontario, Ore. Soil-moisture measurements were made in the corrugation and on the ridge in each plot before and after irrigation. Available manpower limited the number of samples but preliminary indications are that sub-soiling increased the moisture penetration. Later observations of root distribution and yield will indicate the effect of deep placement of fertilizer."

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